

Florida Department of Transportation District Four
Drainage Connection Permits
Applicant and Reviewer
Guide

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CHAPTER ONE: *THE RULES*

I. DRAINAGE CONNECTION PERMIT JURISDICTION AND PURPOSE

A. The Department's jurisdiction for Drainage Connection Permits is defined in Florida Administrative Code (FAC) Rule Chapter 14-86. The rule was last rewritten and adopted on January 20, 2009.



Find Rule Chapter 14-86 at

<https://www.flrules.org/gateway/ChapterHome.asp?Chapter=14-86>

B. The purpose of Rule Chapter 14-86 is to ensure safe conditions and the integrity of the Department's transportation facilities and to prevent an unreasonable burden on lower properties by providing standards and procedures for drainage connections from the properties adjacent to the Department's right of way.

C. Rule Chapter 14-86 requires demonstration that there is no increase of run-off discharge to the Department's right of way from the proposed improvements. Therefore, the allowable discharge to the Department's right of way is based on the approach known as pre-development versus post-development.

II. IMPROVEMENTS REQUIRE A DRAINAGE CONNECTION PERMIT

Any site abutting the Department's right of way or easement, undergoing development or changing grades is subject to this rule unless the improvement qualifies for an exception.

III. DRAINAGE CONNECTION PERMIT EXCEPTIONS

A permit application is not required for projects that qualify for an exception. However, to receive written verification of the exception, a completed Drainage Connection Permit Application (Form 850-040-06) and appropriate back up materials are required.

A. Exception criteria follow:

1. A single family home, not being developed or improved as part of a larger common plan of improvement.
2. Agricultural land, not being developed or improved as part of a larger common plan of improvement.
3. Sites separated from the Department's right of way by an existing canal, providing that the proposed development is not draining towards the driveway connection to the State Road.
4. Projects that reduce the impervious area without reducing the existing storage of the site and changing the existing grades.

B. Exception packages are submitted to the appropriate Operations Center and shall include the following:

1. Completed Drainage Connection Permit Application (Form 850-040-06) with Exception checked on Part 1/Page 2.
2. Recent survey plans, certified by a Professional Land Surveyor Certified in the State of Florida.
3. Scaled paving, grading and drainage plans reflecting pre-development and post-development conditions. The plans shall be signed and sealed by a Professional Engineer certified by the State of Florida.
4. Land-use area calculations.

IV. DRAINAGE CONNECTION PERMIT EXCEPTION OR APPLICATION TRAIL

A. Broward, Palm Beach, Martin or St Lucie County Projects

1. An applicant may schedule a pre-application meeting to review the Drainage Connection Permit process, applicable criteria and/or requirements, as well as ongoing Department roadway projects adjacent to the site. Department representatives from the Drainage Office, the District Permits Office, the appropriate Operations Center, or other offices will attend as needed.
2. An applicant submits complete permit package to the appropriate Operations Center.



Find Operations Center Information in CHAPTER SIX

3. The Operations Center assigns a permit number and reviews the package for completeness. The Operations Center forwards the complete package to the Drainage Office. The Drainage Office logs the package into the Drainage database and assigns a reviewer.
4. The Drainage Office reviewer checks the application, computations, and plans for compliance with the procedures established in Rule Chapter 14-86, these guidelines, acceptable drainage design practice and Department design criteria. The Drainage database Project Summary Form is completed for the project. The Drainage Office Engineer completes the review within two-weeks.
5. If additional information is required and/or computations or plans need modification, a Request for Information (RFI) is sent to the applicant's Engineer. A copy of the RFI is sent to the Operations Center. The Operations Center and District Permits Office are informed of changes requested by the Drainage Office which affect the driveway plans. The applicant's Engineer submits four (4) copies of the additional information directly to the Drainage Office. Upon receipt of the additional information, the log-in and review process is repeated. The previously submitted materials are tossed and replaced with the re-submittal materials.

6. Once the application package is deemed acceptable, the permit is approved. Special Conditions are recorded and the District Drainage Connection Permits Engineer or Reviewer signs Form 850-040-06. The approved package is returned to the Operations Center. The permit package contains four (4) sets of the final approved plans and computations. The Operations Center contacts the applicant for collection of the permit. The issuance of the Drainage Connection Permit may depend on the status of other permit applications for the project (i.e. Driveway Connection, General Permit).

7. The District Permits Office keeps a record copy in perpetuity.

8. Certified, as-built plans are submitted to the Operations Center when construction is complete. The Operations Center manages the permit throughout construction, including inspections, verifications, field changes and permit expiration extensions requests.

B. Indian River County Projects

1. An applicant may schedule a pre-application meeting to review the Drainage Connection Permit process, applicable criteria and/or requirements, as well as ongoing Department roadway projects adjacent to the site. Department representatives from the Drainage Office, the District Permits Office, the Treasure Coast Operations Center, or other offices will attend as needed.

2. An applicant submits complete permit package to the Asset Management Contractor Office.



Find Operations Center Information in CHAPTER SIX

3. The FDOT Asset Management Contractor Office assigns a permit number and reviews the package for completeness.

4. The FDOT Asset Management Contractor Office reviewer checks application, computations, and plans for compliance with the procedures established in Rule Chapter 14-86, these guidelines, acceptable drainage design practice and Department design criteria. The FDOT Asset Management Contractor Office completes the review within two-weeks.

5. If additional information is required and/or computations or plans need modification, a Request for Information (RFI) is sent to the applicant's Engineer. The applicant's Engineer submits four (4) copies of the additional information directly to the Asset Management Contractor Office. Upon receipt of the additional information, the log-in and review process is repeated. The previously submitted materials are tossed and replaced with the re-submittal materials.

6. Once the application package is deemed acceptable, Special Conditions are recorded and the permit is forwarded to the Drainage Office for final approval. The District Drainage Connection Permits Engineer or Reviewer signs Form 850-040-06. The approved package is returned to the FDOT Asset Management Contractor Office. The permit package contains four (4) sets of the final approved plans and computations. The FDOT Asset Management Contractor Office contacts the applicant for collection of the permit. The issuance of the Drainage Connection Permit may depend on the status of other permit applications for the project (i.e. Driveway Connection, General Permit).

7. The District Permits Office keeps a record copy in perpetuity.

8. Certified, as-built plans are submitted to the FDOT Asset Management Contractor Office when construction is complete. The FDOT Asset Management Contractor manages the permit throughout construction, including inspections, verifications, field changes and permit expiration extensions requests.

V. DISTRICT FOUR DRAINAGE CONNECTION PERMIT CRITERIA

District Four applies Rule Chapter 14-86 as it is written. Interpretation and clarification of the criteria follow.

A. Rule Chapter 14-86 allows no increase in run-off discharge to the Department's right of way from proposed improvements. Demonstration of the rule requires a critical duration storm event analysis of 48 storm events. Although additional storms may be required, District Four normally limits these analyses to the design storm event required by the Water Management District, usually one of the events listed.

1. 25-year/72-hour event
2. 100-year/24-hour event
3. 10-year/72-hour event
4. Mean annual/24-hour event, SJRWMD Only

B. District Four does not allow direct, piped connections to the Department's storm sewer systems. Existing connections constructed prior to the 1986 adoption of Rule Chapter 14-86 and previously permitted connections are grandfathered. Sites having a pre-development discharge to the Department's right of way shall connect to the Department's systems with conveyance types similar to the existing, such as sheetflow across sidewalks or driveways.

C. District Four requires permanent, concrete weirs in control structures that discharge to the Department's right of way.

D. Although the Drainage Connection Permit does NOT authorize work within the right of way, the Drainage Office reviews the work on the Department's right of way for compliance with the following:

1. Driveways shall not impede conveyance of the Department's swales. Appropriately sized side drain culverts shall be provided. Side drain culvert cover and safety bars shall be in compliance with Standard Index 205, 272, and 273.
2. Increasing the pavement area of a State Road requires mitigation for the additional impervious area and the additional runoff.
3. Reduction in the volume of the Department's existing storage areas such as, swales, ditches, or ponds, necessitates a calculation of the storage volume and mitigation of the loss. Mitigation options follow:
 - a) Provide an equal amount of storage volume within the Department's right of way by widening swales, adding exfiltration trenches, or increasing existing pond areas.
 - b) Provide an equal amount of storage volume on the permit site and the means to accept the Department's inflows including closed flume inlets or ditch bottom inlet with piping. The applicant will retain maintenance responsibilities for all systems built on the permit site for the collection and storage of runoff from the Department's right of way. The applicant will be required to provide the Department with a drainage easement for any required storage volume on the permit site. The easement language will provide the Department with a right of entry to the permit site for the purpose of providing maintenance to the drainage facility should the property owner not comply with their responsibilities to maintain the system. The document shall also stipulate that any cost incurred by the Department in maintaining the permitted system which otherwise was required to be maintained by the property owner would be charged to the property owner.
4. Construction of new swales or modification of existing swales within the Department's right of way shall be in compliance with the Department Standards such as:
 - a) Geometry of the swale, slopes 1:4 max within clear zone
 - b) Bottom of swale elevation set at a minimum of 1 foot above the seasonal high ground water table (SHGWT) elevation
 - c) Velocity of swale conveyance less than 4 feet per second in grassed areas using the 10-year/1-day event
 - d) Minimum one-foot clearance between the roadway base and the sustained water surface stage using the 25-year/3-day event
5. Construction of new exfiltration trench (French drain) within the Department's right of way shall be in compliance with the Department

Exfiltration Trench Handbook. According to Section 3.2.2, only the fraction of the overall exfiltration trench storage volume, including pipe and aggregate voids located above the design ground water elevation and below the outfall control elevation is considered for discharge attenuation. District Four appreciates the variability of soil conditions and ground water elevations. Therefore, additional storage credit may be allowed depending on the conditions at the site. It is unlikely that the storage credit will exceed the volume calculated by the SFWMD Exfiltration Trench equation.

6. Alterations to the location of the Department's curb inlets
 - a) A spread analysis in accordance with the FDOT Drainage Manual and Storm Drain Handbook is required.
 - b) Locating driveways at roadway profile low points should be avoided. If the driveway must be located at the roadway profile low point, the existing sag curb inlet shall be replaced with a gutter inlet and continuous curb inlets on both sides of the driveway.
 - c) FDOT requirements dictate that curb inlets in FDOT right of way cannot be located within a curve radius.
7. Construction of piping systems within the Department's right of way requires corrosion series testing for the selection of the proposed pipe material. The proposed life expectancy of the proposed material shall be in compliance with the Department Standards. Reinforced concrete pipe (RCP) does not require the service life analysis.



See Chapter 6 of the FDOT Drainage Manual

8. The minimum allowable pipe diameter is 18 inches.
9. Modifications to the Department's Surface Water Management permits required as a result of the applicant's proposed improvements are to be prepared and secured by the applicant.



Find Requirements in CHAPTER TWO, The Application Package

CHAPTER TWO: *THE APPLICATION PACKAGE*

A total of four (4) packages are required to process the Drainage Connection Permit Application. Each package shall include the following:

- ❑ Form 850-040-06, each copy bearing the original signature of the applicant or authorizing agent as well as the original signature and seal of the licensed professional. If the applicant is not the property owner, the property owner must complete and sign Part 4/Page 5 – Owner’s Authorization of a Representative.



See Tips for Completing the Forms

- ❑ Pre-application meeting minutes, if applicable.
- ❑ Soils report supporting the drainage design. The report shall be signed and sealed by a Professional Engineer certified by the State of Florida representing the laboratory performing the testing.



See Tips for Soils Report

- ❑ Existing site photographs in hard copy format. A file with digital photographs is helpful. Each photograph shall be labeled with a description. The required photos follow.
 1. A view of the site in each direction (North, East, South and West).
 2. A view of the State Road both upstream and downstream from the proposed driveway connection(s), if applicable.
 3. Existing drainage facilities directly connected to the Department’s drainage system, if applicable.
 4. Existing drainage facilities with the Department’s right of way adjacent to the site, if applicable.
- ❑ Vicinity map reflecting the location of the site. This map shall include latitude and longitude as well as section, township and range information. This map shall reflect all adjacent local streets as well as at least one major street or highway both upstream and downstream of the site.
- ❑ Recent survey plan, certified by a Professional Land Surveyor Certified in the State of Florida.
- ❑ Scaled paving, grading and drainage plans reflecting pre-development and post-development conditions. Each set of plans shall be signed and sealed by a Professional Engineer certified by the State of Florida.



See Tips for PG&D Plans Requirement

- ❑ On-site drainage report reflecting pre-development and post-development drainage analysis. Each drainage report shall be signed and sealed by a Professional Engineer certified by the State of Florida.



See Tips for Drainage Report Requirements

- ❑ Department's right of way impacts report reflecting all work proposed on the Department's right of way. Each report shall be signed and sealed by a Professional Engineer certified by the State of Florida. The Drainage Connection Permit does NOT authorize work within the Department's right of way.



See Tips for Department's Right of Way Requirements

- ❑ Proof of ownership (i.e. warranty deed or long-term lease)

In order to expedite the review of the application; the applicant is requested to submit the following appendices:

- Appendix A: Soils Report
- Appendix B: Photographic Journal
- Appendix C: Paving, Grading and Drainage Plans
- Appendix D: On-site Drainage Report
- Appendix E: Department's Right of Way Impacts Report

APPLICATION PACKAGE TIPS



FORM 850-040-006

The following are examples that accurately provide the needed information. Acceptable descriptions are not limited to these examples.

1. FORM 850-040-06, Page 3 of 8 Brief Description of Facility and Proposed Connection

Development of vacant land

OR

Minor site improvements to developed land

OR

Major site improvements to developed land

AND

No discharge to the Department's right of way.

OR

Allowable discharge to State Road # roadside swale through a control structure with #-inch outfall pipe with MES.

OR

Allowable discharge to State Road # closed storm sewer system by sheetflow from bubble-up structure.

2. FORM 850-040-06 Page 3 of 8, Brief Description of Why This Activity Requires a Drainage Connection Permit Including Where the Stormwater Will Discharge

Although the site does not discharge to the Department's right of way, it is located within 250-feet of State Road #. The site discharges to Water Management District Canal #.

OR

The site discharges to State Road # roadside swale.

AND

On-site retention up to the #-year, #-day storm event.

OR

Dry detention with outfall into State Road # roadside swale.

OR

Wet detention pond with outfall into Water Management District Canal#.

OR.

Exfiltration trench with overflow into well.

AND

No discharge to the Department's right of way.

OR

Allowable discharge to State Road # roadside swale through a control structure with #-inch outfall pipe with MES #-feet north of south property line.

OR

Allowable discharge to State Road # closed storm sewer system by sheetflow from bubble-up structure.

APPLICATION PACKAGE TIPS



THE SOILS REPORT

In support of the drainage computations, a Soils report documenting the supporting soil information shall be provided. The Soils report shall include:

1. Description of the hydrologic soil parameters
2. Recommended Curve Numbers
3. Soil coefficients for unpaved areas
4. Infiltration and exfiltration rates, as applicable
5. Seasonal high ground water table (SHGWT) elevation determination

APPLICATION PACKAGE TIPS



THE PG&D PLANS

Scaled paving, grading and drainage plans shall reflect pre-development and post-development conditions. Each set of plans shall be signed and sealed by a Professional Engineer certified by the State of Florida. The plans shall include:

- ☐ North arrow
- ☐ Adjacent streets, labeled
- ☐ Numerical and graphical scales
- ☐ Bench mark and vertical datum
- ☐ Clearly delineated property lines
- ☐ Clearly delineated easements
- ☐ Clearly delineated construction boundary
- ☐ Location of all utilities within construction area
- ☐ Existing drainage features such as, inlets, pipes, exfiltration trenches, swales, ponds, control structures; dimensioned and labeled with elevations
- ☐ Existing grading details
- ☐ Existing drainage flow arrows
- ☐ Proposed improvements such as buildings, parking lots,
- ☐ Proposed stormwater management system features such as such as, inlets, pipes, exfiltration trenches, swales, ponds, control structures; dimensioned and labeled with elevations
- ☐ Proposed grading details
- ☐ Proposed drainage flow arrows
- ☐ Proposed elevations along property line adjacent to State Roads
- ☐ Proposed high point elevation on all driveways

APPLICATION PACKAGE TIPS



THE ON-SITE DRAINAGE REPORT

On-site drainage report shall include pre-development and post-development drainage analysis. Each drainage report shall be signed and sealed by a Professional Engineer certified by the State of Florida. The drainage report shall include:

- ❑ Narrative of existing site and proposed improvements
- ❑ Reference to drainage analysis methodologies
- ❑ Total drainage area impacted by the proposed project
- ❑ Explanation of assumptions and back-up calculations for weirs (or bleeders) used in flood-routing software to model a scenario that does not have a control structure
- ❑ Pre-development pervious and impervious areas
- ❑ Post-development pervious and impervious areas
- ❑ Determination of curve numbers (CN) and/or runoff coefficients (c), as applicable
- ❑ Pre-development stage-storage relationship
- ❑ Post-development stage-storage relationship
- ❑ Determination of pre-development discharge to Department right of way
- ❑ Determination of post-development discharge to Department right of way

APPLICATION PACKAGE TIPS



THE DEPARTMENT'S RIGHT OF WAY IMPACTS REPORT

Although the Drainage Connection Permit does NOT authorize work within the right of way, the Drainage Office reviews the work on the Department's right of way. A plan and cross-section view of the work within the Department's right of way is required. All existing and proposed drainage features must be shown. Projects that include major work on the Department's right of way may require additional information and calculations. However, most projects are permitted based on reports including the following.

I. Driveway Impacts

A. Narrative

1. Description of the Department's existing drainage system, such as *a closed drainage system with curb inlets OR a roadside swale with intermediate cross-drains*
2. Impacts to the Department's drainage system, such as *no alterations to the inlets or pipes OR moving an existing continuous inlet out of the proposed driveway OR crossing a roadside swale*
3. Mitigation of impacts to the Department's drainage system, such as *replacing a sag inlet with upstream and downstream continuous inlets and valley gutter and inlet OR constructing a #-inch RCP side-drain under the driveway and re-grading the swale for compensatory volume*

B. Calculations

1. Spread calculations for curb inlet alterations
2. Side-drain pipe sizing
3. Storage volume calculation of loss and compensation

II. Widening Impacts (Turn Lanes and Bus Bays)

A. Narrative

1. Description of the proposed improvement, such as *right turn lane OR bus bay*
2. Description of the Department's existing drainage system, such as *a closed drainage system with curb inlets OR a roadside swale with intermediate cross-drains*
3. Impacts to the Department's drainage system, such as *adding impervious area OR no alterations to the inlets or pipes OR changing an existing curb inlet to a manhole and adding a curb inlet to accommodate widening OR filling a roadside swale*
4. Mitigation of impacts to the Department's drainage system, such as *providing # acre-feet of treatment for # square-feet of additional impervious area OR re-grading the swale for compensatory volume*

B. Calculations

1. Additional impervious area
2. Required water quality volume
3. Provided water quality volume
4. Spread calculations for curb inlet alterations
5. Side-drain pipe sizing
6. Storage volume calculation of loss and compensation

CHAPTER THREE: *THE REVIEW GUIDE*

The Drainage Connection Permit application review is divided into two parts: review of the site and review of the Department's right of way.

PART ONE: *THE SITE*

Drainage Connection Permit applications are reviewed as one of two types: no discharge to the Department's right of way or allowable discharge to the Department's right of way.

TYPE ONE: *NO DISCHARGE TO THE DEPARTMENT'S RIGHT OF WAY*

If there is no post-development discharge to the Department's right of way, no pre-development review is necessary. The review consists of confirming there is no post-development discharge.

- ❑ Verify permission to discharge to others, if applicable
- ❑ Verify no discharge to the Department's right of way
 - Compare the maximum stage within the site caused by the design storm event to the elevations along the Department's right of way
 - Compare the maximum stage within the site caused by the design storm event to the driveway connection highpoint
- ❑ Verify maximum stage determination
 - Check control elevation and/or seasonal high ground water elevation
 - Check soil storage
 - Check site storage
 - Check stormwater management facility storage
 - Check stage-storage relationship
 - Check rainfall amounts
 - Check weir data
 - Check orifice data

TYPE TWO: *ALLOWABLE DISCHARGE TO THE DEPARTMENT'S RIGHT OF WAY*

If there is post-development discharge to the Department's right of way, a review of both the pre-development and post-development is necessary. The review consists of confirming the allowable discharge and that the post-development discharge does not exceed the allowable discharge.

- ❑ Verify allowable discharge
 - Verify pre-development conditions
 - Check existing topography and photos to establish portion of site flowing to the Department's right of way
 - Check control elevation and/or seasonal high ground water elevation
 - Check soil storage
 - Check site storage
 - Check stormwater management facility storage
 - Check stage-storage relationship

- Check rainfall amounts
 - Check weir data
 - Check orifice data
- Check water quality
- Verify post-development discharge is not more than allowable discharge
 - Verify post-development conditions
 - Check control elevation and/or seasonal high ground water elevation
 - Check soil storage
 - Check site storage
 - Check stormwater management facility storage
 - Check stage-storage relationship
 - Check rainfall amounts
 - Check weir data
 - Check orifice data
 - Verify outfall conditions
 - Check location
 - Check pipe size

PART TWO: *THE DEPARTMENT'S RIGHT OF WAY*

- Driveways crossing roadside swales
 - Check swale conveyance
 - Check swale volume loss
- Driveways in urban areas
 - Check curb inlet placement
- Roadway Widening
 - Check additional impervious
 - Check water quality
- Check minimum pipe size
- Check length of pipe without maintenance access

CHAPTER FOUR: *THE REVIEW CHECKS*

CONTROL ELEVATION AND/OR SEASONAL HIGH GROUND WATER ELEVATION

The source of the control elevation can be the Soils report; however, the groundwater elevation must be adjusted to seasonal high. Publications of groundwater elevations may be used.

SOIL STORAGE

Soil storage should be determined using the SFWMD method. SFWMD expresses soil storage as a function of depth to water table and adjusts for compaction in the SFWMD Permitting Manual, Surface Water Design Aids page E-1. All developed sites should be adjusted for compaction.

The site-wide soil storage is an input for flood-routing software.

SITE STORAGE

Site storage is based on topography and grading plans. Linear and vertical storage calculations are acceptable.

STORMWATER MANAGEMENT FACILITY STORAGE

Stormwater management storage is based on grading plans. Linear and vertical storage calculations are acceptable. Exfiltration trench storage starts at the bottom and ends at the top of the trench. Pond/swale storage starts at the Control Elevation for wet ponds and the bottom elevation for dry ponds. The pond/swale storage stops at the top of bank.

EXFILTRATION TRENCH

The use of exfiltration trench as storage to control discharge is a subjective topic with very little consistent criteria. The Department Exfiltration Trench Handbook allows only the fraction of the overall exfiltration trench storage volume including pipe and aggregate voids, located above the design ground water elevation and below the outfall control elevation, to be considered for discharge attenuation. It is standard practice for SFWMD to limit the storage volume to the 5-year, 1-hour rainfall depth over the entire project area. Because of the lack of reasonable criteria, District Four reviews each permit application considering site specifics. District Four appreciates the variability of soil conditions and ground water elevations. Therefore, the minimum allowable storage will be based on the Department Exfiltration Trench Handbook method. It is unlikely that the storage credit will exceed the volume calculated by the SFWMD Exfiltration Trench equation for the 5-year, 1-hour rainfall depth.

STAGE-STORAGE RELATIONSHIP

Site storage and stormwater management facility storage are combined.

RAINFALL AMOUNTS

If the source publication is not provided, use rainfall amounts from SFWMD Permitting Manual, Surface Water Design Aids pages C-1 through C-11.

WEIR DATA

The weir elevation, length, and type used in the drainage analysis shall correspond with the plans. The weir is an input for flood-routing software.

Weirs in control structures that discharge to the Department's right of way shall be permanent, cast concrete.

ORIFICE DATA

The orifice elevation and size used in the drainage analysis shall correspond with the plans. The orifice data is an input for flood-routing software.

WATER QUALITY

The water quality criterion is established by others. The most common is the greater of 1-inch over the total area or 2.5-inches over the impervious area.

LOCATION

Structures should not be located in the Department's right of way. If there is no alternative, special condition is added to the permit. The special condition names the applicant responsible for the maintenance of the structure.

PIPE SIZE

The outfall pipe size capacity should be related to the allowable discharge, using $Velocity = Q/A$. Solving for diameter, $d = \sqrt{(4Q/V\pi)}$. Assume velocity of 2.0 to 2.5 feet per second.

SWALE CONVEYANCE

Driveways crossing roadside swales shall have a side-drain culvert. The culvert size should be based on a calculated Q and checked with upstream/downstream side-drains.

SWALE VOLUME LOSS

Loss of storage volume should be confirmed with simple geometry calculation. Replacement volume shall be provided, preferably on the Department's right of way. Follow the directions for compensating volume off the Department's right of way and get easement.

CURB INLET PLACEMENT

Replacement or added curb inlets should be appropriate for application. For example, low points require a sag inlet.

ADDITIONAL IMPERVIOUS

Additional impervious should be confirmed with simple geometry calculation.

CHAPTER FIVE: *EQUATIONS AND SAMPLES*

SOIL STORAGE

Total Project Area 10-Acres

Pervious Project Area 3-Acres

Average Site Grade Elevation 10-Feet, NGVD

Average SHGWT Elevation 4-Feet, NGVD

Soil Compacted

Average Depth to Water Table = Average Site Grade Elevation – Average SHGWT
= 10 – 4 = 6-Feet

From SFWMD Table, Soil Storage for Depth to Water Table > 4-Feet is 8.18-Inches

Available Soil Storage = Storage Available * Pervious Area
= 8.18-Inches * 3-Acres
= 24.54-Acre-Inches = 2.04-Acre-Feet

Soil Storage Entire Site (S) = Available Soil Storage over Entire Site
= 2.04-Acre-Feet / 10-Acres
= 0.20-Feet = 2.45-Inches

SCS CURVE NUMBER

SCS Curve Number = $1000/(S+10)$
= $1000/(2.54+10)$
= 80

RUNOFF VOLUME

P=Rainfall Depth in Inches

S=Soil Storage Entire Site

Inches of Runoff = $(P - (0.2 \times S)) / (P + (0.8 \times S))$

Volume of Runoff = (Inches of Runoff) x (Total Project Area) x (1ft/12in)

From SFWMD Manual, P=11-inches

Inches of Runoff = $(11 - (0.2 \times 2.45)) / (11 + (0.8 \times 2.45)) = 8.51$ Inches

Volume of Runoff = (8.51) x (10) x (1ft/12in) = 7.10 Acre-Feet

PRE VS POST RUNOFF VOLUME COMPARISON

Calculate the RUNOFF VOLUME using the Pre-Development Conditions

Calculate the RUNOFF VOLUME using the Post-Development Conditions

Calculate the change in RUNOFF VOLUME

Provide that amount of storage within the site

WATER QUALITY

Total Project Area	10-Acres
Pervious Project Area	3-Acres
Impervious Project Area	6-Acres
Building Area	2-Acres
Roads and Parking Area	4-Acres
Lakes	1-Acre

Required volume is the greater of...

One inch over the entire site = Total Project Area * 1-Inch
 = 10-Acres * 1-Inch
 = 10-Acre-Inches = 0.83-Acre-Feet

2.5 inches over the impervious area = Total Project Area – (Water Surface + Building) * 2.5-Inches
 = (10 – (1+2)) * 2.5-Inches
 = 17.5-Acre-Inches = 1.46-Acre-Feet

Required volume is 1.46-Acre-Feet

WEIR DISCHARGE

Basic Weir Equation $Q = 3.13LH^{1.5}$

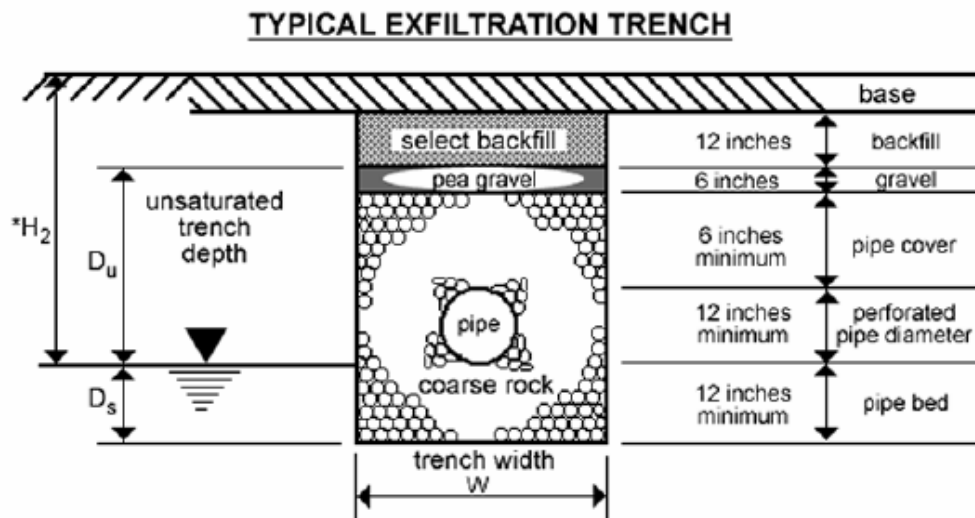
 Q = Discharge, cfs

 L = Weir length, feet

 H = Head on weir, feet

EXFILTRATION TRENCH

Use the SFWMD equation.



$$L = \frac{V}{K (H_2 W + 2 H_2 D_u - D_u^2 + 2 H_2 D_s) + (1.39 \times 10^{-4}) W D_u}$$

L = Length of Trench Required (feet)

V = Volume Treated (acre – inches)

W = Trench Width (feet)

K = Hydraulic Conductivity (cfs/ft.² – ft. head)

H_2 = Depth to Water Table (feet)

D_u = Non-Saturated Trench Depth (feet)

D_s = Saturated Trench Depth (feet)

- * The value of H_2 to be used in the equation is the effective head on the saturated surface. A weir must be installed at the downstream end of the trench, to create true retention and to establish H_2 . To achieve the design retention and exfiltration, the crest of the weir must be no lower than the top of the trench pipe.

Figure F-4

CHAPTER SIX: *DISTRICT FOUR*

Florida Department of Transportation District Four jurisdiction includes Broward, Palm Beach, Martin, St Lucie and Indian River Counties.



OPERATIONS CENTERS

Broward County

Broward Operations
5548 NW 9 Avenue
Fort Lauderdale, Florida 33309
(954) 776-4300

Palm Beach County

Palm Beach Operations
7900 Forest Hill Boulevard
West Palm Beach, Florida 33413
(561) 432-4966

Martin and St Lucie Counties

Treasure Coast Operations Center
3603 Oleander Avenue
Fort Pierce, Florida 34982
(772) 465-7396

Indian River County

FDOT Asset Management Contractor
Transfield Services 420 4th Lane SW
Vero Beach, Florida 32962
(772) 299-1554

DISTRICT OFFICE
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Fort Lauderdale, Florida 33309

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